WATER MANAGEMENT PLAN

PREPARED BY

C-b SHALE OIL VENTURE

ASHLAND COLORADO, INC.

OCCIDENTAL OIL SHALE, INC.

AUGUST 18, 1977

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SUMMARY AND CONCLUSIONS

This report represents a water management plan for the Tract C-b Oil Shale project.

According to present estimates, the flow rates of mine water expected may be adequate for satisfaction of any water depletion over the life of the project. However, segregation of mine water from process water will be assured. Mine water will be treated to reduce flouride, boron, and total dissolved solids.

Defluoridation can be achieved using activated alumina. Boron removal, if required, can be provided through the use of Amberlite XE-243, a boron-specific ion exchange resin. The concentration of dissolved total solids can be reduced by demineralizing part of the mine water stream and blending it with the remainder.

Other aqueous streams requiring treatment are the retort process water and the sour water condensate from the retorting off-gas. Process water will be fed to a Thermosludge boiler for steam generation, while sour water condensate will be used as feedwater for a conventional boiler, after degassing and possibly removal of any excess oil.

Capital and operating costs for the process units required are presented. Other treatment options are also considered.

"Comprehensive" and "outline" water balances for the project are presented. The flow rates calculated show that a net amount of water is produced during retorting operations, but is subsequently lost as stack gas. Other consumptive uses originate from surface activities.

A prospective location for an on-tract storage reservoir providing 5000 acre feet of capacity for treated mine water is described. An estimate of construction costs is also included. Geological studies will confirm the feasibility of on-tract storage of large amounts of water. The location of solar evaporation ponds for impoundment of concentrated residues from demineralizer regeneration brine and Thermosludge blowdown have been tentatively selected.

INTRODUCTION

Sufficient data have now become available for an overall consideration of a water management plan for the C-b Shale Oil Venture Project. The following water management aspects have been considered in this report:

Mine Dewatering

Augmentation of more Senior Water Rights

Water Treatment Alternatives

Overall Water Balance

Water Storage and Impoundment Sites

The following sources have contributed information which is part of this report: Ashland Colorado, Inc.; Occidental Oil Shale, Inc. (Occidental); Davis, Graham, and Stubbs (D,G & S); Energy Consulting Associates (ECA); The Ralph M. Parsons Company (Parsons); Tipton & Kalmbach, Inc. (T & K); the United States Geological Survey (USGS).

MINE DEWATERING

The mine water obtained is of fairly good quality. Typical water quality data for the upper and lower mine aquifiers are shown in Table 1, together with USGS water quality data for Piceance Creek above Hunter Creek. This location is approximately one mile downstream from the main entrance to C-b Tract.

The objectionable constituents are fluoride, boron, and possibly high total dissolved solids. Fluoride is present in amounts ranging up to 20 mg/l. Boron has been found in amounts ranging from 0.1 to 10 mg/l and occasionally up to 12 mg/l. Total dissolved solids fall within the 750-1000 mg/l range in the zone planned for mining.

Table 1 - Typical Water Quality Data, Mine Aquifers and Piceance Creek

Constituent	Concentration (mg/litre unless noted)		
	Upper ** Aquifer	Lower ** Aquifer	Piceance Creek Above Hunter Creek*
Bicarbonate	350 - 2100	100 - 25000	309 - 690
Boron	<.1 - 10	.05 - 12	0.13 - 0.47
Calcium	4 - 100	2 - 28	16 - 88
Carbonate	<1 - 75	7 - 2000	0 - 85
Chloride	2 - 49	1 - 9800	11 - 16
Fluroide	.3 - 20	4 - 50	.3 - 1.5
Magnesium	3 - 150	1 - 10	44 - 88
Silica	4 - 30	2 - 40	12 - 20
Sodium	44 - 1200	200 - 2500	97 - 200
Sulfate	<4 - 520	<4 - 300	170 - 390
Total Dissolved Solids	540 - 3100	350 - 42000	584 - 1090
pH (units)	8.1 - 9.0	8.4 - 9.1	7.5 - 9.2

*Latest published USGS data, water year Oct. 1974 to Oct. 1976, Guaging Station 09306061.

**Ranges taken from Final Baseline Report, Volume 2, P. 315-328.

Process water (obtained mixed with oil from retort operations), on the other hand, contains dissolved organics and high salt concentrations, and its treatment requires special procedures.

Process water will be kept separate from mine water. During the commercial stage, drifts being continuously built in the vicinity of working retorts will provide a suitable dewatering area. During the ancillary development stage, on the other hand, specific dewatering drifts may be built in the proximity of the first groups of two and four retorts to avoid flooding them and contaminating the mine water with process water.

Water inflow into a conventionally sunk shaft will be controlled by grouting so as to limit the amount of water to about 25 gpm. This water will be ponded or used for irrigation. Water inflow into the drilled shafts will be retained in the shaft during drilling operations.

The water treatment plant and/or injection facilities for the initial retorts, will be designed, procurred and constructed in order to handle 2500 gpm by July 1, 1978. This will allow the water treatment plant and/or injection facilities to be ready to handle water that will need to be pumped from the drilled shaft.

AUGMENTATION OF MORE SENIOR WATER RIGHTS

The statutes of the State of Colorado and recent decisions of the Colorado Supreme Court establish the obligation of replacing diverted water if this action causes a depletion of the water sources in the area. According to a commonly followed interpretation, however, one does not always have to return all the water withdrawn, but only an amount of water sufficient to replenish the actual shortage caused.

The effect of dewatering the mine is expected to be experienced directly in an area contained within a circle of 7 mile radius centered in the middle of Tract C-b. The lowering of the pieziometric head in the valley bottom may also influence groundwater discharge to Piceance Creek within a 10 mile reach with consequent increase of salinity in the lower stream flow, which is of poorer quality due mainly to irrigation returns. Springs that result from perched water bodies will not be affected by dewatering.

It is expected that present flow values will have to be maintained in Piceance Creek in the proximity of the tract, if mine dewatering is found to cause a decrease. In addition, parties presently using wells in the area will have to be compensated for any loss of water that may occur.

Stream flow depletion has been estimated to range from 0 to 4000 gpm over the 60-year life of the mine. The average annual augmentation requirement is estimated at 2500 gpm. According to the USGS computer model of the Piceance Creek Basin, stream depletion due to dewatering at Tract C-b would reach 2700 gpm after 30 years of operation.

WATER TREATMENT ALTERNATIVES

Mine water will require treatment for removal of fluoride, boron, and to reduce the total dissolved solids. Retort process water also requires adequate treatment and disposition.

It is expected that during commercial operation the water requirements for the facility will be satisfied by the water available on site. Treatment, however, is required for almost all end uses, including revegetation, raw shale disposal, and dust control.

Fluoride will be removed from mine water using activated alumina, which is the most effective reagent in the concentration range considered. Fluoride is removed by ion exchange and alumina is regenerated by contacting with caustic,

followed by neutralization with sulfuric acid. A leading supplier of de-flouridation systems, Pureflow Corporation (Oklahoma City, Oklahoma) has estimated the following package costs (including a building to house the units and heating to prevent freezing):

Capacity (gpm)	Capital Cost ($)	Operating Cost/ 1000 Gallons
4,000	1,000,000	.08 ¢
6,000	1,350,000	.08 ¢
8,000	1,700,000	.07 ¢
10,000	2,000,000	.07 ¢

The Rohm & Haas Company (Philadelphia, Pennsylvania) manufactures an ion exchange resin (Amberlite XE-243) which has been developed specifically for boron removal. The resin has been used in commercial applications in California, for removal of boron from irrigation water. The resin is regenerated with caustic and sulfuric acid, i.e., the same regeneration procedure could be applied to both alumnia and XE-243.

According to the Pureflow Corporation, a layered bed system is feasible, i.e., both fluoride and boron could be removed using the same mechanical equipment. A system capable of removing both contaminants would cost approximately 60% more (capital and operating costs) than for fluoride alone, mainly due to the high cost of XE-243.

It is possible that alumnia, which is chemically similiar to magnesia, may also remove part of the boron present in the mine water. Specific information on treatment parameters require laboratory tests using mine water.

Excess dissolved solids can be removed by demineralization using a dual bed cationic/anionic resin ion exchange system. The following approximate costs for a demineralizing system (installed) have been supplied by the Philco-Degremont Company (Richmond, Virginia):

Capacity (gpm)	Capital Costs ($)	Operating Cost/1000 Gallons
1,000	300,000	0.29 ¢
2,500	600,000	0.30 ¢

The demineralizer produces a waste stream consisting of regeneration brine. This stream will be concentrated by a brine evaporator, with the residue impounded in a 20-acre solar evaporation pond. Approximate costs for installed brine evaporator units capable of removing 85% of the water from a 10,000 mg/l demineralizer brine have been provided by the Resources Conservation Company (Renton, Washington) as follows:

Capacity (gpm)	Capital Costs ($)	Operating Cost/1000 Gallons
40	800,000	$ 1.90
80	1,200,000	$ 2.02
140	1,800,000	$ 2.04

A block flow diagram of the mine water treatment scheme is included in the diagrams designated "Outline Water Balance", and "Comprehensive Water Balance".

During the development stage, large amounts of mine water may be produced, while water requirements are limited. At that time, reinjection of mine water could replace treatment and discharge.

Reinjection would create a depletion-enhancement dipole in the aquifer system, and therefore reduce or eliminate augmentation needs.

The following approximate reinjection costs have been supplied by ECA (see also the graphical representation in Figure 1):

Capacity (gpm)	Capital Costs ($)	Operating Cost/1000 Gallons
4,000	2,300,000	$ 1.43
6,000	3,700,000	$ 1.27
8,000	4,400,000	$ 1.12
10,000	5,000,000	$ 1.24

Costs for reinjection and treatment were not prepared on a comparable basis.

Two additional streams will receive treatment: one is the sour water condensate, obtained on cooling to 95-100°F the gas product stream; the other is the retort process water, separated from the shale oil. The sour water condensate can be conveniently utilized as feedwater for a conventional boiler, following stripping to remove hydrogen sulfide and ammonia, and possibly further treatment to remove oil and other organics.

Retort process water requires a special treatment system, because of the high salinity and the organic content. The treatment selected, consists of feeding the process water to an unconventional boiler, heated by a molten salt bath (the Ameron "Thermosludge" process). A 10% blowdown rate will be required; the brine will be concentrated in a multi-stage brine evaporator prior to impoundment in an imprevious solar evaporation pond covering approximately 10 acres.

Currently available Thermosludge units can handle 50 gpm of feedwater, have a six-month delivery time, and cost (installed) approximately $350,000. Double-size units, handling 100 gpm, are considered for development; these units would be supplied at $700,000 for the first unit, and $600,000 for subsequent units, with an expected development time (for the first unit) of 14 months. The estimated commercial phase flow rate (see Water Balance) of retort process water is 420 gpm, and would require nine conventional units, for a total cost of $3,150,000.

The installed cost of a brine evaporator unit capable of 85% concentration of the Thermosludge boiler blowdown (40 gpm, 100,000 mg/l) has been estimated by the Resources Conservation Company (Renton, Washington) at $800,000; the operating costs per year for the unit have been estimated at $40,000.

An attractive alternative during the commercial stage may involve the reinjection of water into the operating retorts in place of steam. The water could be atomized and mixed with the air stream. However, this concept still requires field testing prior to its adoption.

An alternative, under consideration, is to ship process water by pipeline to Rangely, together with oil. The water would be separated from the oil at Rangely, and used for oil field flooding and thus could release equivilent quantities of good quality water presently being drawn from the White River to a more beneficial use.

The incremental costs of transporting the water with the oil have been estimated using the following parameters:

Flow rate of process water (including boiler blowdown): 440 gpm

Flow rate of oil: 57,000 bpd, or 1662.5 gpm

Distance tract C-b - Rangely: 60 miles

Elevation drop from tract C-b to Rangely: 1500 ft

Specific gravity of oil: 0.9

Average viscosity of oil (Saybolt seconds Universal, 100°F): 114

Flow temperature in buried pipeline: 50°F

Average viscosity of oil (Saybolt seconds Universal, 50°F): 600

Diameter of pipeline: 14 in.

Under these conditions, the following requirements were estimated:

	Pumping Pressure (psi)	Power Consumption (kw)
Oil Alone	750	900
Two-Phase Flow	1000	1400

These estimates show that with the introduction of the water into the line would increase the pumping pressure by about 250 psi and the power consumption by about 500 kw. With power at 2¢/kwh the increase in operating cost would be about $80,000/year. Because of the higher pressure, and also because the two-phase flow line would have to be installed somewhat deeper to ensure against freezing in winter, the two-phase line is estimated to be about $25,000/mile, or $1,500,000 more costly.

Process water treatment costs by pipeline shipment are therefore approximately one-half the costs estimated for the Thermosludge treatment option. During the development stage, prior to completion of the pipeline, two 50 gpm Thermosludge units will still be required.

During initial development, while the first retorts are being constructed, mine water will be the only stream requiring treatment. A 2500 gpm treatment system is expected to afford adequate capacity for this initial stage.

OVERALL WATER BALANCE

The "Comprehensive Water Balance" block flow diagram depicts in detail the source and disposition of the various aqueous streams. The "Outline Water Balance" block flow diagram which follows it summarizes water sources, treatment procedures, and uses contemplated, andaffords a "first glance" picture of the water management plan. Both block flow diagrams include tables which detail the flow volumes for two retorts, four retorts, and commercial facility for both retort configurations. Stream accounting where the net inflow balances the net outflow is presented

separately for the "Comprehensive Water Balance" and jointly with the flow rates for the "Outline Water Balance". Domestic sewage is treated by a conventional package treatment plant, consisting of secondary treatment, chlorination, and sludge digestion, with the effluent used for revegetation and dust control.

The expected range of mine water flow is estimated along with volume rates for raw shale disposal, dust control, and revegetation. Basic parameters used in process calculations, are:

Water content of the air - 2% by volume.

Feed gas composition - 70% air on dry basis, 30% steam (by volume).

Product gas to inlet air factor - 143.5% (dry basis).

Water released from shale retorting - 3.4% (by weight of shale).

Product gas water content - 25% (by volume).

During the retort process only a minor amount of water is consumed by the water gas reaction (generation of hydrogen and carbon monoxide by reaction of carbon with steam); a net amount of water is produced during retorting (approximately 600 gpm for the commercial operation). Net consumptive use ranges up to 1250 gpm in the commercial operation and are all above ground. These include dust control, revegetation, general facility, construction, sanitary and ventilation exhaust (i.e., the water is lost to the atmosphere).

As shown by the flow values, a surplus of water is available in all cases, for use to augment stream flows or other depletions. However, if water requirements were to increase during the life of the mine (for example due to dust control and revegetation of more extensive areas) additional augmentation water will be imported from either the White or Colorado Rivers.

Stormwater runoff has not received individual consideration in the water balance.

It is expected that good housekeeping will limit the amount of contaminated runoff from diked sites in the process area to very small volumes and will be treated with the process water.

WATER STORAGE AND IMPOUNDMENT SITES

A sizable water storage reservoir for treated mine water is desirable because it provides flow equalization for the treatment system, flexibility for augmentation, emergency supplies of water, and upset conditions.

A storage capacity of 5000 acre feet (1.6 billion gal) is considered adequate. At a mine water flow rate of 10,000 gpm, this capacity could provide storage for 112 days, or approximately four months.

A dam site located at the north end of Scandard Gulch (Figure 2) was considered appropriate. This site provides the required capacity and is in a suitable location with respect to the initial retort operations, which will provide the largest discharge volumes. The specific site will be confirmed by geotechnical investigations.

An additional consideration for this site is the drainage area (approximately 5,400 acres), estimated to yield 1100 acre feet (assuming the 100 year rain is 2.5" of water) of runoff. A capacity increase to accommodate this additional amount would require considerable increase in the dam height. An attractive alternative is to build an additional dam upstream to impound storm runoff.

Estimated construction costs for the water storage reservoir and the runoff detention basin are shown in Table 2. A typical dam section showing the type of materials required and a general configuration is depicted in Figure 3.

Figure 2 also indicates the location of the mine waste area and of the solar evaporation ponds. The concentrated residue from demineralizer operations will be impounded in the solar ponds located near the ancillary area; the concentrated residue from the Thermosludge units will be impounded in the solar ponds approximately 0.5 mile north of the process area. Both ponds will be shallow (depth range 3-6 feet) to provide a large evaporation surface. The pond area (20 acres for the demineralizer residue and 10 acres for the Thermosludge residue) provide a six-month storage capacity to compensate for zero evaporation during the winter months.

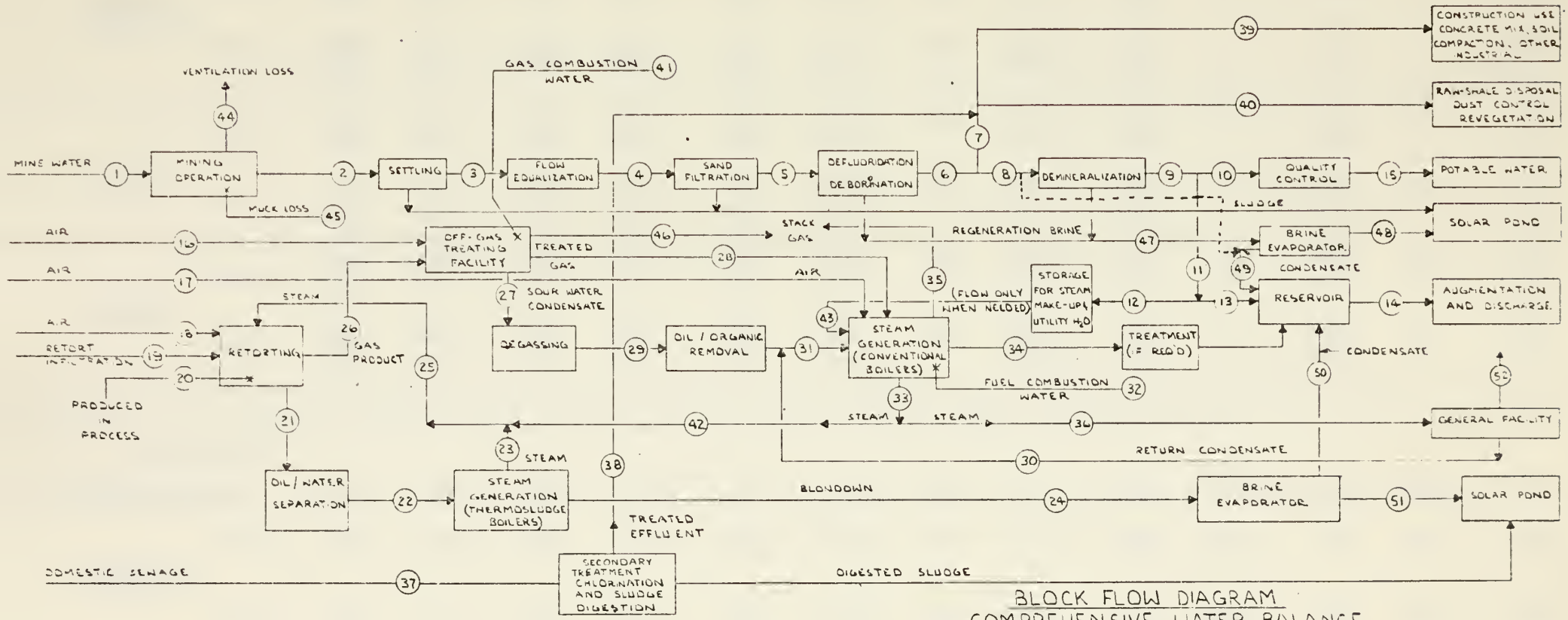
During initial development, while the first retorts are being constructed, any excess water will be stored in a temporary one-million gal plastic lined storage basin located in Cottonwood Gulch. The drill mud generated will be impounded in a half-acre pond located in proximity of the mine shafts of the ancillary area.

A pond will be constructed in Cottonwood Gulch and a dam in Sorgham Gulch to contain any water produced during early shaft sinking. These will be covered with raw shale as the other dams in Scandard are finished.

Irrigation of range land on tract can also serve as additional consumptive use during early years when surplus water is available.

Table 2 - Dam Construction Costs ($)

Items	Cost
Construction of storage reservoir ($4/cu yd; volume: 2,394,100 cu yd)	$ 9,576,400
Construction of runoff basin dam ($4/cu yd; volume: 1,350,000 cu yd)	5,400,000
Flume (8000 ft)	800,000
24 in. pipe from approximate location of water treatment plant to discharge point at NW corner	45,000
Total expenditure, present worth	$ 15,821,400



BLOCK FLOW DIAGRAM
COMPREHENSIVE WATER BALANCE

CONFIGURATION		STREAM (GPM) 1	2	3	4	5	6	7	8	9	10	11	12	13
COMMERCIAL FACILITY	HFFR	4000 10500	3690 10190	3690 10190	3690 10190	3690 10190	3690 10190	1000	2650 9190	2650 9050	70	2580 8980	0	2580 8980
	VFFR	4000 10500	3820 10320	3820 10320	3820 10320	3820 10320	3820 10320	1000	2820 9320	2778 9180	70	2708 9110	0	2708 9110
4 RETORTS	HFFR	6000 8500	5920 8420	5920 8420	5920 8420	5920 8420	5920 8420	900	5020 7520	4945 7408	70	4875 7338	225	4650 7113
	VFFR	6000 8500	5920 8420	5920 8420	5920 8420	5920 8420	5920 8420	900	5020 7520	4945 7408	70	4875 7338	138	4737 7200
2 RETORTS	HFFR	4500 6500	4457 6457	4457 6457	4457 6457	4457 6457	4457 6457	650	3807 5807	3750 5720	70	3680 5650	320	3360 5330
	VFFR	4500 6500	4457 6457	4457 6457	4457 6457	4457 6457	4457 6457	650	3807 5807	3750 5720	70	3680 5650	274	3406 5376

CONFIGURATION		STREAM (GPM) 27	28	29	30	31	32	33	34	35	36	37	38	39
COMMERCIAL FACILITY	HFFR	1730	485	1730	200	1930	1488	1754	176	2086	200	50	50	300
	VFFR	1790	510	1790	200	1990	1545	1823	167	2173	200	50	50	300
4 RETORTS	HFFR	148	-	148	0	148	32	355	18	38	238	50	50	300
	VFFR	224	-	224	0	224	31	345	17	37	155	50	50	300
2 RETORTS	HFFR	74	-	74	0	74	34	375	19	40	319	50	50	300
	VFFR	112	-	112	0	112	33	368	18	39	277	50	50	300

CONFIGURATION	STREAM (GPM)	14	15	16	17	18	19	20	21	22	23	24*	25	26
COMMERCIAL FACILITY	HFFR	2861 9346	70	-	113	95	76	574	420	420	336	84	1890	2215
	VFFR	2994 9469	70	-	118	98	71	594	426	426	340	86	1963	2300
4 RETORTS	HFFR	4741 7235	70	12	6	8	27	48	56	56	45	11	162	189
	VFFR	4830 7324	70	18	6	12	26	74	69	69	55	14	245	288
2 RETORTS	HFFR	3432 5428	70	6	6	4	16	25	31	31	25	6	81	95
	VFFR	3479 5475	70	9	6	6	18	37	40	40	32	8	123	144

*Figures shown represent 20% blowdown rate, which will be corrected to 10% in final version.

CONFIGURATION	STREAM (GPM)	40	41	42	43	44	45	46	47	48	49	50	51	52
COMMERCIAL FACILITY	HFFR	750	-	1554	0	260	50	-	40 140	6 21	34 119	71	13	0
	VFFR	750	-	1623	0	130	50	-	42 140	6 21	36 119	73	13	0
4 RETORTS	HFFR	650	163	117	225	75	5	216	75 112	11 17	64 95	9	2	238
	VFFR	650	248	190	138	75	5	330	75 112	11 17	64 95	12	2	155
2 RETORTS	HFFR	400	81	56	320	38	5	108	57 87	9 13	48 74	5	1	319
	VFFR	400	124	91	274	38	5	165	57	9	48	7	1	277

COMPREHENSIVE WATER BALANCE

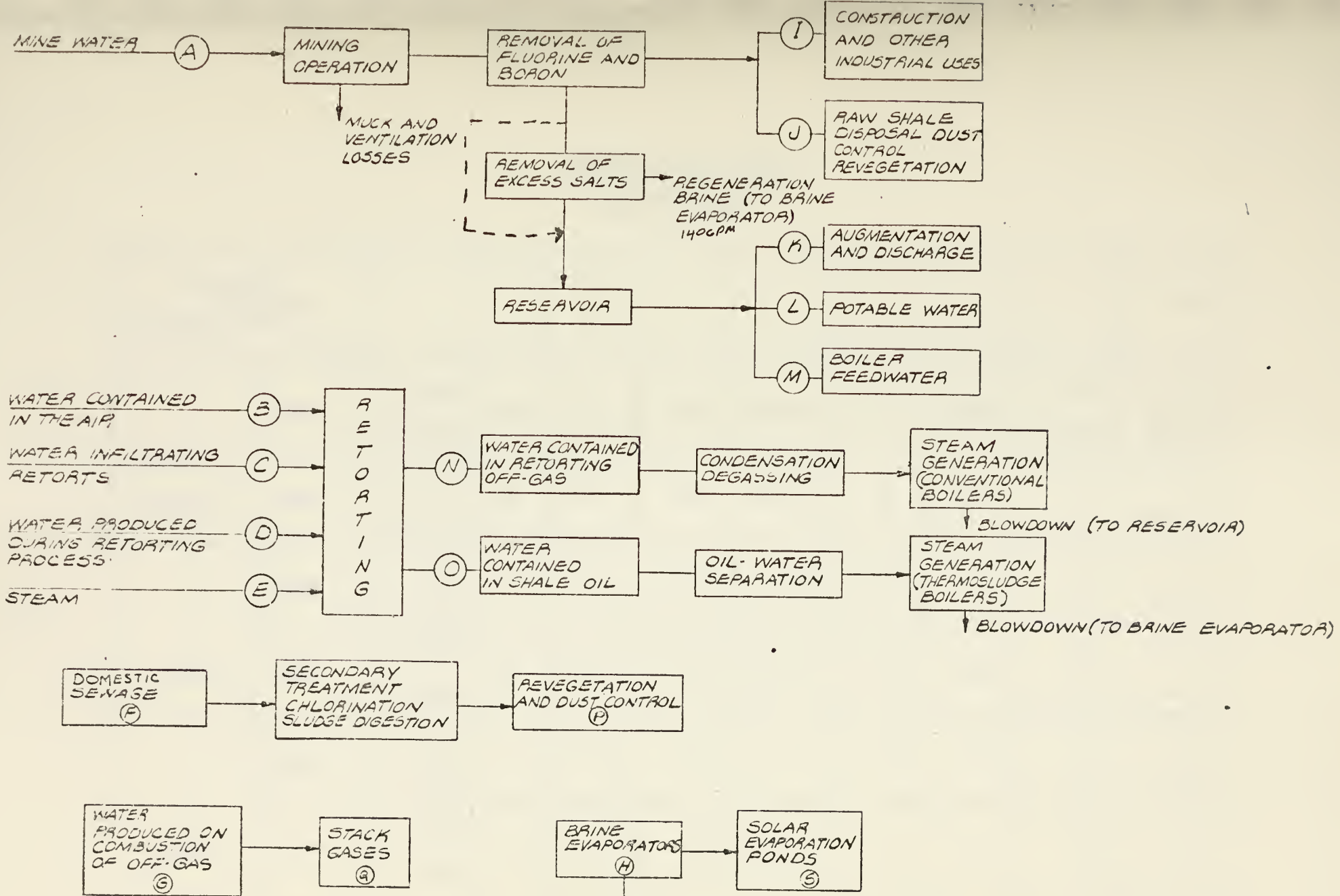
NET INFLOW

STREAM NO.	COMMERCIAL FACILITY				4 RETORTS				2 RETORTS			
	HFFR		VFFR		HFFR		VFFR		HFFR		VFFR	
1	4000	10500	4000	10500	6000	8500	6000	8500	4500	6500	4500	6500
16	0	0	0	0	12	12	18	18	6	6	9	9
17	113	113	118	118	6	6	6	6	6	6	6	6
18	95	95	98	98	8	8	12	12	4	4	6	6
19	76	76	71	71	27	27	26	26	16	16	18	18
20	574	574	594	594	48	48	74	74	25	25	37	37
37	50	50	50	50	50	50	50	50	50	50	50	50
41	0	0	0	0	163	163	248	248	81	81	124	124
32	1488	1488	1545	1545	32	32	31	31	34	34	33	33
TOTAL	6396	12896	6476	12976	6346	8846	6465	8965	4722	6722	4783	6783

COMPREHENSIVE WATER BALANCE

NET OUTFLOW

STREAM NO.	COMMERCIAL FACILITY				4 RETORTS				2 RETORTS			
	HFFR		VFFR		HFFR		VFFR		HFFR		VFFR	
44	260	260	130	130	75	75	75	75	38	38	38	38
45	50	50	50	50	5	5	5	5	5	5	5	5
46	0	0	0	0	216	216	330	330	108	108	165	165
35	2086	2086	2173	2173	38	38	37	37	40	40	39	39
39	300	300	300	300	300	300	300	300	300	300	300	300
40	750	750	750	750	650	650	650	650	400	400	400	400
15	70	70	70	70	70	70	70	70	70	70	70	70
48	6	21	6	21	11	17	11	17	9	13	9	13
14	2861	9346	2984	9469	4741	7235	4830	7324	3432	5428	3479	5475
51	13	13	13	13	2	2	2	2	1	1	1	1
52	0	0	0	0	238	238	155	155	319	319	277	277
TOTAL	6396	12896	6476	12976	6346	8846	6465	8965	4722	6722	4783	6783



BLOCK FLOW DIAGRAM
OUTLINE WATER BALANCE

OUTLINE WATER BALANCE

INFLOW STREAMS

CONFIGURATION \ INFLOW (GPM)		A	B	C	D	E	F	G	H	TOTAL
COMMERCIAL FACILITY	HFFR	4000 - 10500	95	76	574	1890	50	1488	124 - 224	8297 - 14897
	VFFR	4000 - 10500	98	71	594	1963	50	1545	128 - 226	8449 - 15047
4 RETORTS	HFFR	6000 - 8500	8	27	48	162	50	163	86 - 123	6544 - 9081
	VFFR	6000 - 8500	12	26	74	245	50	248	89 - 126	6744 - 9281
2 RETORTS	HFFR	4500 - 6500	4	16	25	81	50	81	63 - 93	4820 - 6850
	VFFR	4500 - 6500	6	18	37	123	50	124	65 - 95	4923 - 6953

OUTLINE WATER BALANCE

OUTFLOW STREAMS

CONFIGURATION \ OUT FLOW (GPM)		I	J	K	L	M	N	O	P	Q	R	S	TOTAL
COMMERCIAL FACILITY	HFFR	300	750	2880 - 8930	70	0	2215	420	50	1488	105 - 190	19 - 34	8297 - 14897
	VFFR	300	750	2880 - 8930	70	0	2300	426	50	1545	109 - 192	19 - 34	8449 - 15047
4 RETORTS	HFFR	300	650	4755 - 7255	70	225	189	56	50	163	73 - 104	13 - 19	6544 - 9081
	VFFR	300	650	4842 - 7342	70	138	288	69	50	248	76 - 107	13 - 19	6744 - 9281
2 RETORTS	HFFR	300	400	3410 - 5410	70	320	95	31	50	81	53 - 79	10 - 14	4820 - 6850
	VFFR	300	400	3456 - 5456	70	274	144	40	50	124	55 - 81	10 - 14	4923 - 6953

ESTIMATED COSTS FOR REINJECTION OF MINE WATERS ON TRACT C-b

RIO BLANCO CO., COLORADO

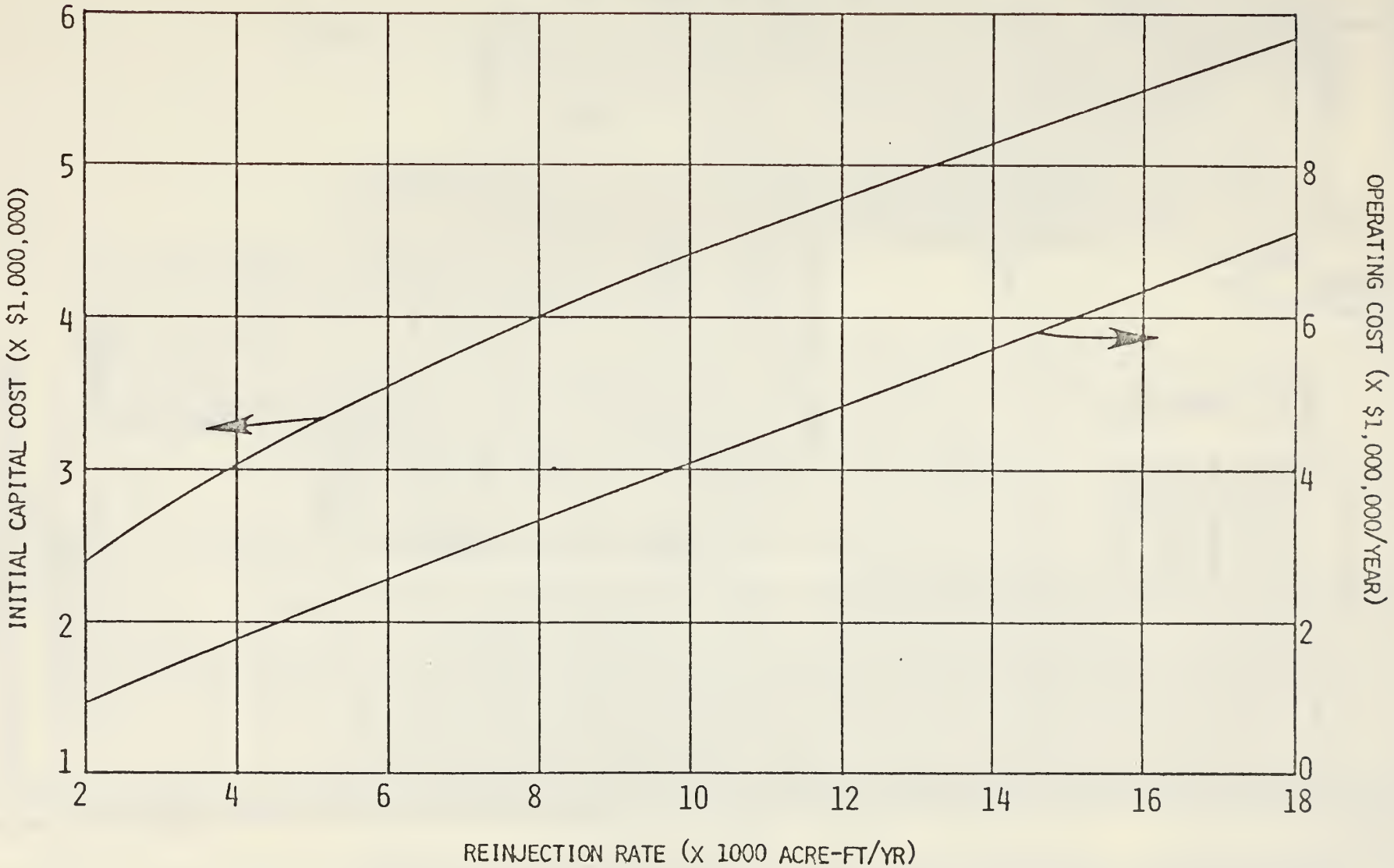


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Figure 1

Figure 2

BILL OF MATERIAL

OCCIDENTAL OIL SHALE INCORPORATED

C-b SHALE OIL VENTURE

RIO BLANCO COUNTY COLORADO

PARSONS JURDER
DIVISION OF
THE RALPH M. PARSONS COMPANY

GENERAL

CIVIL

TRACT SITE PLAN

01-C5-4

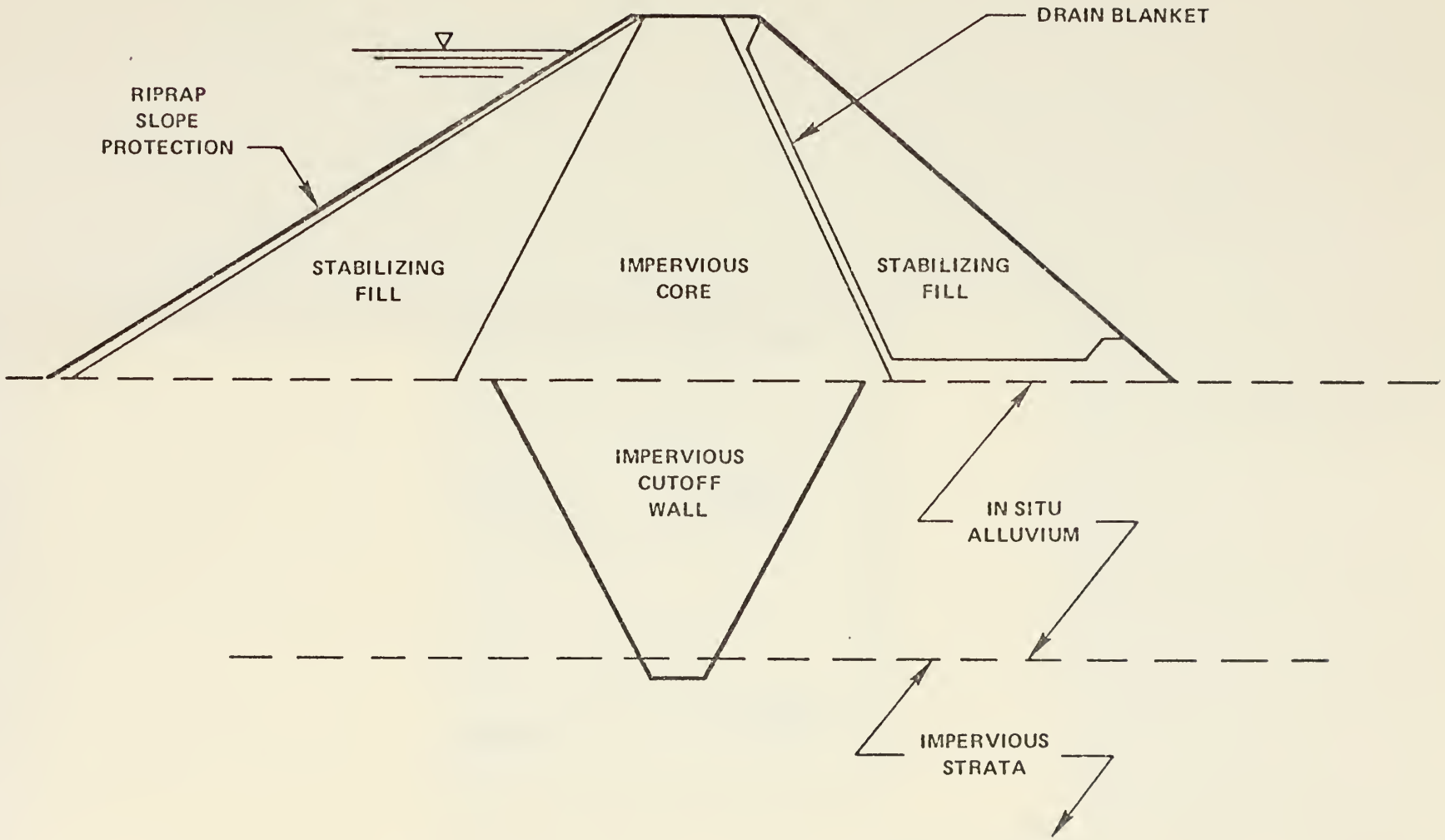

Figure 3 - Cross Section of Typical
Dam Structure

Form 1279-3
(June 1984)

BORROWER'S

TN 859 .C64 C374

Water management

DATE LOANED	BORROWER

USDI – BLM